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SEQUENCE LISTING

<110> Imperial College Innovations, Ltd.

<120> Bacterial Virulence Genes

<130> MRM/PJG/24342

<150> GB 0228691.2

<151> 2002-12-09

<160> 63

<170> PatentIn version 3.2

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748

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atggacgata ttaaagcggg atttactgca aacggcgtaa gtgcagcgga ttttgataat 180
ggcataata gctttgcggt aaatggtttg gtaaacaac aagtacaatt agcagaagat 240
tttaaaattc gcggcgatcc ggcgtttttc ataaacggac agtaccaaata caatttgga 300
ggctttgccc attccgcac aaccaacgaa tttgtgaaac gttatgtaga agcggtgact 360
tttttaatta aaaagtaaat taagggcata gtagacaaaa tggttgctat tttttgaaaa 420
actatgccaa gtggacaaag tgggtggctaa atagtatttt ttattttatt tagccactct 480
ttttatttaa aaaatccttt ataaacataa cattatgtga ctacttaata ccattatgat 540
tatttaattt ccgcttcagt tcactaaata atccttcag tctatttgtc gtcttttcaa 600
tatttaattc cgggtatttt tcataagtaa aaatataatc catataacgt ttaatactcg 660
cataagcact tctcacattt caatgtttat agggaaaata accctgctca tt 712

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<210> 14
<211> 496
<212> DNA
<213> Actinobacillus pleuropneumoniae

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- 11 -

<400> 14
 tgcttagttt agacggtgta ccggcaatta aagcgattgt cgatgcaacg gaaaaacatg 60
 ataacgatga aaagcacgag catgatcacg accataagga cgatcataaa catgaccacg 120
 acgatcataa acacgaccat gcagggcatg atcatcacca tgatcacgaa gggcatagcc 180
 atgataaaga ttggcatatt tggttctcac cggaagcaag ccttgccgcg gcggaacaaa 240
 tcgcagcacg tctaagcgca caattaccgg aacaaaaagc gaaaattgcg gaaaaccttg 300
 caacatttaa agcaaattta accgctaaaa acgaacaaat tcgcaatcaa ttagcagcag 360
 taaaaggtaa aggttattat actttccatg atgcttacgg ctatttcgaa cgtgcttacg 420
 gattaacctc attagggtcg tttagcatta acccgagcgt agcgccgggg gcgaaaacgt 480
 taagcgtaat taagaa 496

<210> 15
 <211> 408
 <212> DNA
 <213> Actinobacillus pleuropneumoniae

<400> 15
 agctctacat catctaaata accgaattca gcagcaaaaa gaactaatgc ttgttcgctt 60
 accagcattg gagcaaattg tttttgttta agtaattccg tcaacttttg accgtgagaa 120
 agctgtttac gagtcgcac atctaaatcg gaagcaaatt gagcaaacgc cgctaattca 180
 cgatactgag ctaatgcggt acggataccg ccagataatt tcttgatagc tttagtttgc 240
 gccgcagaac ctacacgaga tacggaaata cccgggttta ccgcaggacg aataacctgag 300
 ttaaataaac ttgactctaa gaaaatctga ccgtcagtaa tagaaattac gtttgcgga 360
 acgaaagccg atacgtcacc cgcttggtgc tcgataatcg gaatgcag 408

<210> 16
 <211> 476
 <212> DNA
 <213> Actinobacillus pleuropneumoniae

<400> 16
 cgcttaaccc cgttactaaa tgagttcaac gtttaggtat ttccgttcag caagtaaacc 60
 gccaaacatt ggataacaaa gcgcaagggtg aagttcacca agggattatt gcgaaagtcg 120
 tgccgcaaaa agagctgaac gaacatgatc tggatgctat tctggcgcaa aaacaaaacc 180
 cgtttttatt aatcttagac ggtgtgaccg atccgcataa ccttggtgct tgtttgcgta 240
 ctgcagatgc ggcagggtgtg gatgcggtga ttgtaccgaa agataaatcg gcacagctta 300

- 12 -

cctcaaccgc tcgtaaagta gcttgcggtg cggcggaaac cgtgccgtta attcgtgtta 360
 ccaaccttgc tcgcacaatg cgagagctac aagagcaaca taatatctgg attgtcggca 420
 cggcaggtga agcgacttcc ggtatttatac aggctaaatt aaccggtgct atcgct 476

<210> 17

<211> 1011

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 17

attgcgcaaa atgctaacag aattatcaaa atcaaagatg gcgaaattat tgcagataat 60
 agttcatact gcaagaatag cctctcccc tcaacaaagc aggaaaggca aagtctaaac 120
 tgcttgatgt cgctacgagg ctataaagaa tcttttgtga tggcattcag tatgatgcgt 180
 gctcataaaa ttaggacgtt tttgactatg ttaggtataa ttattggcat tgctgctgtc 240
 gtatgtgtag tagcattagg agaaggaacc aaacataaag tcttgaatga atttagctct 300
 ttaggtagca acacaataga tatttttcct ggtaaaaatt ggggagatac cgaagcatat 360
 aaaattcaaa cgtaaatag caatgacgta aatttattac gccaacaacc ctatgtgaaa 420
 ggtgcgactc cgaacttatac gttagaattg ccaatccgtt tcttaaataa aactgccaat 480
 gcaacgataa atgggtgtag ccaagatttc tttatgttaa aaaactacaa attactaagt 540
 ggcagattttt ttaaccaaca agatgtagat acttatcaag ctgttggcat aattgataaa 600
 aaatcacgag atgtaatctt cggcacaaaa attgcagaaa gcaatatagt ttttatcggt 660
 gatgtacctt tttcgattat cgggtgttgtt gagtccgcct cccaaacaac tgaagggcag 720
 cgaaccacta tttggttacc gtacaacact atggctgctc gtttacgtaa ccaaccctat 780
 tttcaacaaa ttacagtga gttacgagaa aattttgtac cagcagcagc cgataaggct 840
 attgtggatt tattggcagc aaagcaatcc atatcatggc agataggatt tttttacttt 900
 cagtagcagc aagttcttgc aatccttaaa tcgcactaca cagccctaac tttaatgatt 960
 tcactatcgc cttttatttc gctggtagtt ggaggtatag gagttatgaa t 1011

<210> 18

<211> 650

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 18

tcgacgctga gcgtctttat atgggcaatg gtgaggggta gttttacctt ttgcataggg 60

- 13 -

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tgtgcatatt acagatagaa agcaaaatag tcaaagagaa aatcggattt ttaaaaaata 120
tctcataagc taaactaaat aaaccgaacc ggtttgatat aaggtaaact tatagaaatt 180
tttcacgtct aaccatagca aaaaagcgat aaaactggta atttgactat tcgtatctga 240
aaactattct tatttttaat ttaaaccgga tgacaatggt atttgcgatt ttagcaatgc 300
tggtcttatgc tgccgcatta ttatgggtta cccccacact cgtcaattta gaaaaccaa 360
ccggtgataa aaaaccgaat cttaaagcgg tttttggatt cggcttactt gccgtattct 420
ttcacgcaat caatttatcg caagaattgg tgctgagcgt gctgagcgag ggcggtcaga 480
atttctcact ttctaacgta aactcaatga tgagcttatt gctgacggct gtcgcaacac 540
ttgccttacc gcgttgga aaaccatttgg ttccgttaat ggtggtttat accttcggca 600
tttgtagcgt agcggcatcc gcatttgcca gcggtaactt tattaataat 650

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<210> 19

<211> 620

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 19

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gcaataacctg cactcggggc gtcttttcggc gttgcgccgt ccggcacgcg tacgtgaata 60
tcacgttttt catagaaggc atccgcactg cctaattgtg cggatcttgc acgtaccacc 120
atcattgccc cttgaatcga ttctttcatc acatcgcccta atgaaccggg aaatgagaat 180
ttacctttac cgccgaccga agtggttttcg atggtgagta aatcgccgcc gaattccgtc 240
caagctaagc cggttacttc accgacacgg ttttggctgt ccattttacc gtaatcaaaa 300
cgttttacac ccaagtaatc ggcgatattg ccttcgggta ctgtaattga tttgactttt 360
ttgtccaaca ccagagtttt caccgcttta cgacagatct tagcaatttc acgttcaaga 420
ctacgcacac cagcttcacg agtgtagtaa cgaataatgc ttaaaatagc actatcttcg 480
atagttaatt caccgcgttt taagccgtta ttttcttgct gtttggcaat taagtgggtca 540
cgggcaatgt gcattttctc atcttcggta taaccggaaa gacgaatcac ttccatacgg 600
tcgagtaatg ccggcggaat 620

```

<210> 20

<211> 272

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 20

- 14 -

```

agcgaagcta ccgctcgaag taaaagaaaa actagatagc gagtttaaaa agttaaaagc      60
gatgccgcaa agttcttccg aagcgaccgt cgtacgcggc tatatcgatt gggctctaaa      120
aatgccgtgg aacaaaaaat caactgtgaa aaaagacttg gcgaaagcgc aagaaatttt      180
agacaaagat cactatgggt cggagcgtgt taaagagcgc attgtcgaat accttgcggt      240
acaaagccgg ttaaacaac ttaaaggccc ga      272

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<210> 21

<211> 669

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 21

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agtacctttt caaagcttgg gttgcttttg caaaccaaga ttggattagc gtaatctcat      60
tacttgaaag taagctctct gagttaagta aaaaagactt agatttatat ttgcctgagc      120
tattgcttgc tcgagcttac tgtcaattaa atgactttac ctctcacat aattgtttag      180
ttgcatttga gagacactct gctgcatttc cattgtctcg aatcgaaata gcacacctag      240
cacactctgc cggagcgcca ttgtctcgaa tcgaaatagc acacctagca tatgcaagac      300
gaaattatac aaaatgtatt gatcaactta ataaatgctt tgctaaagaa cttgacaatc      360
tacctgcaga gagtttagag gaatatgtct tttccttact taaaggaaat aacactaagg      420
aatttgaaaa attagtagaa agttctctaa gtgagaagtt taaagatcga actttcttta      480
aaaaagaata tgtttccttt cttgctaaaa atcagttatg gaaaaaatta gttaaatatg      540
ctagcaattg ggcattacaa gataaagaaa aattcaatta tccattaatg cttgctcatt      600
atagattagg agatattgca tatgtttatc agaatcatat aaaaccgact gaagaacatc      660
cctatgaat      669

```

<210> 22

<211> 277

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 22

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ggctttgcag tagcggaac gcaaaatgta tcgtcggata aattaccgga aaatgtggcg      60
ccggcttata ccaaccgca taaagatatc ggtaacattc cggtgacttt ccctcatcaa      120
ccgccgcttg ttccgcatag tattcgtggg ttacaagtaa ctaaaaatac caaccaatgt      180
ttaggttgcc atgcgccgga agtatcaagc acgacgggtg ctccgcgtgt gcctaaaacg      240

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cattttatgg atcgagacgg taaattgacg gaaggaa

277

<210> 23

<211> 807

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 23

tggaagtgac tcgtctgcgt gatacgccga tcttaacttt tatgaacaaa ctcgaccgtg 60
 atatccgtga tccgatggag ttactagatg aagttgaaag cgtcctaaaa atccgttggtg 120
 cgccgattac ttggccgatt ggttgccgta aattatttaa aggcgtctat catattgcaa 180
 aagacgaaac ctatctttat caatccgggtc aaggttcaac cattcaagaa gtacgtatcg 240
 taaaaggctt gagcagccca gaacttgatg ctgcgggtcgg tgatgattta gcgaaccagt 300
 tacgtgaaga attagaactt gtacaagggtg catcaaacga atttgatcac gaagccttta 360
 tcaacggcga actcacaccg gtattcttcg gtaccgcatt aggtaacttc ggtgtggatc 420
 atttcctaga cggtttaacc gaatgggccc caaaaccgca agcacgtcaa accgatgtac 480
 gtacggtcga atcaagcgag gaaaaattct ctggcttcgt gcttcctggt aagatccaag 540
 cgaatatggg ccgaaacac ctacaccgat tggcatttat gcgcggtggg ggaggcaa 600
 accgaaacac ggtcttcaaa ctcaaaccac tacgtatcgc cataagatgt ctgcgatttc 660
 cagatgcctt aacctttatg gcgggtgaac gtgcacatgc tcgaagaagc ttacgcgcgg 720
 cctatattat cggttttacat aaccacggaa caatccaatt cggtgacacc ttcactcacg 780
 gtgaagtgat gaaatttacc gccttcc 807

<210> 24

<211> 402

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 24

cacgcggtac ggatgtcatt ttacatttgc gtgaagcaga aaaagaattt ttaagcgaat 60
 ggcgtttacg tgaaattatc ggtaaatatt cggatcacat cggcttaccg gttgaaatcc 120
 aaaccaccga atatgatgaa gaaggcaaag caagcgggtca aaaatgggaa aaaattaaca 180
 aagcgcaagc actttggact cgttcaaaaa ccgaaatttc agacgaggaa taccaagagt 240
 ttataaaca ttaagccac gattataatg actcgctcat ttgggcgcac aataaagtag 300
 agggtaaaca agactatacc agcttgcttt atgtaccggc gaaagcacca tgggatctgt 360

- 16 -

tcaatcgtga tcaaaaacac ggcttaaaac tttatgacag cg 402

<210> 25
 <211> 551
 <212> DNA
 <213> Actinobacillus pleuropneumoniae

<400> 25
 tatcttcgca tcggtgagcc gccatgttcg gttaaagcc ctactaccca ttcgtcaata 60
 cgatcagata ataacagcac ttcaatgcct ttcttattga acagttcaag gtgcgggcta 120
 tttttcgcgc ccacataact atcagcgggt aagaaataaa tcgctttctg accttctttc 180
 attctgccga tataatccgc caaacttacc gtttggtcgc tagaatcagt ttgggtcgaa 240
 gcaaaacgga ataatgacgc aacttggtgt ttattcgcaa aatcttcacc aacgccttct 300
 tttaacacta aaccgaattc gttccagaag gtttggtatt tagcttgatc gtccttcgct 360
 aatttttcca ataattgcaa tgcacgttta gttaatgccg cacgtagtga agcagtaact 420
 ttattctctt gtaaaatctc acgtgaaacg ttgagcggca agtcattcgt gtctaataaa 480
 ccccgcataa aacgtaggta attcggcata aacactttcg gcacggcca taataaatac 540
 acgctgtaca t 551

<210> 26
 <211> 281
 <212> DNA
 <213> Actinobacillus pleuropneumoniae

<400> 26
 cacttagccc ccaaattagc agttcctaaa aaaaagcctc cctcaaagga agtaaaaaaa 60
 gcgcctgaaa agatcatgaa aaaacatgag acaaagaaag atgtttctcc aacaaacaaa 120
 agcagtcgta ctcagcagcc gatccaacaa ggaaatccaa atggtataaa tggaagcaaa 180
 tcaacctatg gaaatgccaa agtcgatgcc tcccttggtg ctggttatgg caatgcaatg 240
 cgagggccgt tgctctgata tttcagatga atctgatgat g 281

<210> 27
 <211> 735
 <212> DNA
 <213> Actinobacillus pleuropneumoniae

<400> 27
 attatgaacc aattaaaaaa tgatcggttac ttaaaagcgt tactacgtga accagttgat 60
 atgacaccgg tatggatgat gcgtcaagcg gggcggttatc taccggaata taaagcgaca 120

- 17 -

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cgtgcggaag ccggcgattt tatggcttta tgcgcaatg cagatttagc ttgtgaagtg      180
acgttacagc cgctacgccc gctacgccgc tatgcattgg atgcggcgat tttattctcc      240
gatattttta ccgttccgga tgcaatgggc ttaggtttta gtttcggcgc gggngaaggg      300
cctaaatttg ctgcccgat tgaaaataaa gcgcaggtgg acaacttacc gattccggat      360
ccggaaagcg aattacaata tgtgatgaat gcggtacgta ctattcgccg tgaattaaaa      420
ggcgaagtgc cgtaatcgg tttttcaggc agctcgtgga cattggcgac ttatatggtg      480
gaaggcggct caagcaaagc gttcaccaaa attaaaaaaa tgatgtatgc cgatccgaaa      540
attttacacg cattattaga taaattagcc gatagcgtga tcttatatct gaatgcacaa      600
attaaagccg gcgcgcaagc ggtgatggtg ttcgatactt ggggcggcgt gttggcgcat      660
aacgaatata aagagttctc gctacgttat atgcacaaaa tcgtggacgg ttaattcgt      720
gaaaacgaag gcaga                                     735

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<210> 28

<211> 539

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 28

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tgcgtggtat ccacacgatg gaacacttat ttgccggctt atgccgtgat catttaaata      60
gtgaaagtgt agaaattatt gatatttcgc cgatgggttg ccgtaccggt ttctatatgt      120
cgtaatcgg tgcccaagc gaagcggatg tggtttcggc gtggacaaaa tcgatggaag      180
atgctttaaa taaagtaccg gacgtgtcaa aaattccgga attaaacgaa tatcaatgcg      240
gctcttataa agagcattcg cttgaagaag cgcacaaat cgctcgtgat gtgtagcca      300
agggtatcgg cgtaaacggt aacgaagatt tagcgcttga tgagaaatta ttaaattccat      360
aatccttcaa aaaggcgtaa tgtttattac gtctttttct tcttaaaaat atattttaat      420
ctttgacaga cgcttatggc gtcttttagt tttttcagga aagtaagatg ttcaacaaaa      480
tttttagttg gtttgaagca agagtggaaa cttaccccca agcaccgcgc aaaacgccc      539

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<210> 29

<211> 104

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 29

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cgcagtgtaa gtttttgccc gattgcacga tgtagaagaa gtgcggttac tgatgaatcc      60

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- 18 -

acgccgcctg ataaacctaa aatgacttcg tcatcgcta ctg 104

<210> 30

<211> 1201

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 30

tagaaaaact ctgaagtcct tgagaatttc cgctcttcgc catagcctgt aacgcttggg 60

tccggcacgtg taataagctg ttggtcagtt tataacttag ctcgttaagg actttttcac 120

tatcttgtcc actgggtaag gcaactaatg ctttcgctaa tagctcttga cgagtttgct 180

cggcatcttg gcgataacgt ttaatcaaat cgctggattg ctgttggttc agccattcaa 240

agaacgcttt acattcttca tccacaattt gtgccgcttg ttctgcagct tgttctcgtt 300

gcgcatatt acgttgaatg atatgttgta aatcatctac gctgtaagaa tataccgcat 360

ccaattcgcc ggcatttttcg tcaatatcgc gaggaacggc aatatcaatc aataacatcg 420

gatcaaactg gcgttggttc tgtgcgattt ccaccatttc ttgctaatac agcatatccg 480

gactgccggt agaactgata acgatatccg cttgggttaa accgatttgc aatgcgctta 540

atgataaaat ttgcatcggc gtgtttaaac gctccgctcg ctccgctaac gtttccgcac 600

gttgccggcg acggttggcg atcataatgt ttttcgcgcc gtgctgaatt aaataacgcg 660

cgactaatc gatggtttcg ccggcaccga ccaacaagaa acgcaattta ccgaaattat 720

cgaaaatctg gcgtgccaaa ccgcaagcgg cataagcgac cgataccgca cttgaaccga 780

tttccgtttc ggaacgcaca cgttttgccg tcgaaaaggc acgttggaac agacgggata 840

atttagtaga aatatggctg ttctgcgatt ggtaaaaatt ctccgtatat tgataagctt 900

gttttacctg gcctagaatt tgcggctcgc ccaagataag cgaatctaaa ccgcacgcta 960

ctcgcattaa atgacgagcg gcttccatat tttgtttgaa ataaatacat tcgcgtagtt 1020

cattatgttc aagttgatga atttcggcaa accattcaaa acattgttca cgccatgcga 1080

tgttatcttc atgttcttct cgcggcgtaa tttccgcatt atgaaaataa agctctgttc 1140

ggttacacgt tgaaagaatg acaacgcttt cagcaagtgc gcgggggttg aatttgctca 1200

a 1201

<210> 31

<211> 250

<212> DNA

<213> Actinobacillus pleuropneumoniae

- 19 -

<400> 31
agcaaagttt attccaacaa tcaaatctat tgattacgga ctattcatct attgcatttg 60
aaatggcatt tctaggaaaa caaacaatct attaccaatt tgataaagag gaatttagat 120
ctggaattca tacatatcaa caaggatact ttgaatacga gaaagatgga tttggctctg 180
tagctgaaac attagatgat ttatttattc acctagataa attcgtaaac ggtgaaaatg 240
attcataaat 250

<210> 32
<211> 364
<212> DNA
<213> Actinobacillus pleuropneumoniae

<400> 32
cgccacgctt atatacaaca accgccaccg tattggataa attcatactg cggctgtctt 60
tacacattgg cactcggatt ttttgcgaca tcggtaaatt atccaaaatc gtcacgaggga 120
taccacgggt ttccggccca aacataagga agtcgcctaa ttcataactc acttcactat 180
gattcgggtt gccttttagtt gtcagcgcaa atagacgttt tggcttggcg cgttctagaa 240
aatcttcaaa attcttatat ttttgaatat cgacaaattc gtggtaatcc aaacctgaac 300
gacgtagttt tttgtcatcc cacgcaaagc ctaacgggtc aatcatatgt aatctaaaac 360
cgca 364

<210> 33
<211> 486
<212> DNA
<213> Actinobacillus pleuropneumoniae

<400> 33
cgcttggttaa gcgattgccg gtgcggctcg cataagtaac cttcccatat tgtgctttaa 60
tgctgcttcg gtttccgcat cgtttaatgc cgcctaacct aaatcgctta acgccaacc 120
gttgcgcttta aataattctt ccacacgagg ccagttgttc gggcggctta cgtccattgc 180
gtttgaaagc gttgctaccg ttgcgttcgg ttcccattta cctgatttta aataacgcgg 240
cactgtgtca ttcgcattgg ttgatgcgat aaaacgttta attggtaaac ctaaggtttt 300
tgcgattaaa ccagcgggta agttaccgaa gttaccgctt ggtactgaaa ccactacatc 360
agaacgtttt gctttcggta attgtgctac cgcttcaaag taataacaaa cttgcgctaa 420
taaacggctg atattgattg agttttgcgg agttttaage ccgatcgttt gacgtaattc 480
agcaat 486

- 20 -

<210> 34
 <211> 241
 <212> DNA
 <213> *Actinobacillus pleuropneumoniae*

<400> 34
 attgtttccg atatccttga gttagtaa at cctgatttag cccatattca ttgtattcaa 60
 ggcttaggcg ttggtgttgt tgatgcatgc acacaacgaa atataaagac tgctgtaacc 120
 ttacatgatg cttggtggat ttgccctcgc caatttatga ttaaagctga tggtaagttc 180
 tgtcatcaat ataaaattga taaaaatgaa tgtataaaat gtattggtag tacatcagaa 240
 t 241

<210> 35
 <211> 479
 <212> DNA
 <213> *Actinobacillus pleuropneumoniae*

<400> 35
 tactaaacga ggatttttca cttgcggacc ggcaagcgaa ataatacggc cggtaaagag 60
 ttgcctgta gtaaataatt taccgatagc aatcacatct tgataattta agtgccaaac 120
 ttgtttggtc gcccctacgg gatcaacaaa gtggatatgc gtaccgacta aaccggcagg 180
 atgaacaccg ctaaacgact taattgtgat accttcaatc gccggactta acgggatatt 240
 gctgtccgcg tctttacata agtaaaccgg tttttgaccg ttaaataaac gggttaaaac 300
 agttaaacg tctttaaaat cggtttcgta ctcttttaaa accacttccg gatccgccgc 360
 taacggattg gtatccattg cattgacaaa gattgatgac ggaatcgcg ccaatgcggg 420
 aaccttactg aacggacgag tacggaatgc agtcataaaa cccgattcga taagatttt 479

<210> 36
 <211> 380
 <212> DNA
 <213> *Actinobacillus pleuropneumoniae*

<400> 36
 tccacttctt ccgctaccgc tgcagccggc acttcaattt cattttgtgc gattaaaccg 60
 ttgattactt gggttttaac gcgtgcggtt actgcgtttt taagttcacg ttgcatattt 120
 ttcttaattt ccgcacgtaa atcttctaca gtttttgctg aaccgaattt tttcacgaat 180
 tcttcggtta attcaggtaa tacgatattt tctactttct taagtgtaat tgcaatttc 240
 gccgctttac cttttaagtt ttcagcgtgg tattcttcag ggaaagtaac atcgatatcg 300

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aattgttcgc cggctttgtg accaacgata ccttctttaa aaccagggat catacgactt 360
 tgacccattg ctaaagtga 380

<210> 37
 <211> 498
 <212> DNA
 <213> Actinobacillus pleuropneumoniae

<400> 37
 tgcaaaacgt cgtgttcaag taggtttatt actttcaacc gtaatcggta ctaacgaatt 60
 aaaagttgat gaaaaacgtg ttgaagaaac gattgcagaa atcgcttcag cttacgaaca 120
 accggcgga gttgttgctc attatgcgaa aaaccgtcaa ttaaccgaaa atatccgtaa 180
 cgtagtggtta gaagagcaag cggttgaagt tgtacttgcg aaagcaaaag taactgaaaa 240
 agcgacttct tttgatgaag taatggctca acaagctcaa ggctaattct caaacataaa 300
 gctctccggt ttggagggct ttttaattagc attttataag cggttgattt taggaaaaaa 360
 tttgcaaaaa tttctctaaa aatgaccgct ttctttttaa caagaagaga atttagtcat 420
 ggatttaaca ttactcaac agctccaaca atttattgcg gccatccta ttttaatttt 480
 tgcttggatt gccttagt 498

<210> 38
 <211> 604
 <212> DNA
 <213> Actinobacillus pleuropneumoniae

<400> 38
 attatcagga agatgttgat tattatttaa tggcaaaacc aggaatgacg gggctttggc 60
 aggttagtg aagaaataat gttgattata agactcgagt atatttcgat gcttggtatg 120
 taaaaaactg gtctcttttg aacgatattg ctattttatt taaaactatc aatgtattaa 180
 ggagccgaga aggagcttat taatcctata gggctagagt aacttactat gcaatttgcc 240
 ctttacttta taagccggct ggggtaaaat gtactacctt ttttagttct atgtcgccaa 300
 aattgtgtgc gactttattt aaacatatat ttcctgaggt gatggcatat gccagtaatt 360
 aaagttcgtg aaaatgaatc atttgacgtt gcattacgtc gtttcaaacg ctcttgcgaa 420
 aaagcaggtt tattagcaga agttcgcgct cgtgaattct atgaaaaacc aactacaatt 480
 cgtaaacgtg aaaaagcatc ttttagctaaa cgtcacgcta aacgtaatgc tcgtgaaaat 540
 gcacgtaaca ctcgtttata ctaattagca gtcttgctat ttaggcttaa attaactaaa 600

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accg

604

<210> 39
 <211> 410
 <212> DNA
 <213> Actinobacillus pleuropneumoniae

<400> 39
 cagccgagcc tatattgaat tagcggcaaa agtcgcttcg gagctatact ggcaagggtc 60
 ggttatccccg tctgaaatta tgattcgca agtaaaataa gttttaataa ccacgaaaac 120
 acaaagaaca caagcggtag aatttgcaga aaaatctgca aatcctaccg cttttttatt 180
 agtacgattc gctggtggac tgctatttga tttggtttgt caggatatta tgttattgta 240
 atgaaatggt agtgaattat ttttattaat ttgaaaggaa aaaaaatgaa aataaaaaaa 300
 cgttacattg cgctgttggt cttaggtgtc gttatcagct atgcctggta tcaaaattat 360
 caatgggaac agctgatggt aagcgggtat tgtgaaaagg acggaagtta 410

<210> 40
 <211> 330
 <212> DNA
 <213> Actinobacillus pleuropneumoniae

<400> 40
 ggtaagcct aaccgcttat taatgtcttt taatagctgt aaaatcgatt gtgtagtcgc 60
 cggatctaata gcaattgtcg cttcgtcaca taataaaaca tgcggatcac ttgccaacgc 120
 acgggcaatt gcgacacggt gcttctgacc gccggataaa ttgctcggat aaacatcttt 180
 acgttcgggt aagccgacca attcaatcaa ttcgtttact ttcttctcga tctgatcttt 240
 cggcgtattg ctcaacgtaa gcggtaatgc gatattttca tataccgtat gtgatgccaa 300
 caaattaaag tgctggaaaa tcatcgcaat 330

<210> 41
 <211> 952
 <212> DNA
 <213> Actinobacillus pleuropneumoniae

<220>
 <221> misc_feature
 <222> (528)..(528)
 <223> n is a, c, g, or t

<400> 41
 agtaacgctt ccatttttgc tgaaaaatca cgaccaagaa taatctcatc accgtgcaaa 60

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acactactta cggcatggta tcttgcccat ttttgcttta attcgggact ttcgcataac      120
ccgtcgatga acgcatcatc aacttttttc ccgtccataa aagcggaaaag ggtttcattt      180
tggtgcataa taaactccga ttgaatctta aatctgttgc attagcggat tgacctttgc      240
atcaatcgct tctcttgctc taaagatacg cgaacgaacc gtaccgacgg gacattgcat      300
gacttccgca atttcttcat aacttaaacc ttccaactca cgcaaagtaa ttgccgtttt      360
gagttcttca ggtaaatttt caatcgtgtc aaaaacgaca cgttttaatt cttcggatag      420
caccacattt tccggtgtat cactctcacg aagttgaccc ccaacatcaa agctttccgc      480
atcttccgcc aaaatatctt ctttaggagg acgtcttccc aaagcggnta aatgattttt      540
agcagtgttc accgcaatac gataaagcca cgtataaaaag gcgctctctc cacggaaaga      600
ctctaataaa cgatacgctt taataaaaaga ttctgcaca atatccggaa tatcatcacg      660
tgaaacatag cgagttaata aacctgccac tctattctga taacgtacga cgagtaaatt      720
aaatgctttt ttatcacctt tctgtgcacg ttcaaccaat tcttgatcgg ctaccagctc      780
actcatctat ttgcgttctc ctaatctatt tcgcatattc cttattgttc tcattccgta      840
catccttttag tgtgtaacaa aaatgaaaag ttcatataaa gaataaatta ctcaattatt      900
tacaaatact ttaataaaaat tcaataacaa gactaaggat gctacaaata tt          952

```

<210> 42

<211> 1196

<212> DNA

<213> *Actinobacillus pleuropneumoniae*

<400> 42

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aatattttta tgagcgtatt aaagatgaag acaccaatcc gctatccgaa caagagctaa      60
atcaatttgc gatggcatta cgcgtcgaat tacaaaataa accgaatgat gccaaaggct      120
ggtttatgtt aggtcaaate ggcatggcga aagatgacgg gcaattagca ctggaaagct      180
acgaaaaagc cagcaaaactg gacccgaaaa atctgcaata taaaggcagc tacgctcaag      240
tgctgatgtt ctcgcaagat caagcggata aggacagagg taaagcgggtg ctaaaagaaa      300
ttttacgtga agatcatacc aatttagatg cgctcagctt actggctttc agttcttttg      360
aagaacaaga ctataaaatg gcggaatga cttggggcat gatgctaaaa ctgattcctg      420
aaggcgaacc gcgccgcgct acagtagaaa aaagtatcaa tatggcaatg tcgatgttgc      480
aagagcaaga aagcaaacia ccggctaaag cggaagagaa aaaataataa catttttagcg      540
aagctaaaaa ctgatgtcgg gcggttttat acccgcccta aaattgcaaa aggataaata      600

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atgttaagta aagagacatt aaaaatcggg ttggtttccg ttcggaccg tgcctccggc      660
ggcgtttacc aagaccaagg tattcccgaa ttacaagcgt ggttggaatc cgtattaacc      720
gccccgtttg aagtggaaac acgtttaatt ccggacgagc aagctatcat tgagcaaaca      780
ttaattgaat tgggtggatac gcaccactgc catttagtct taaccaccgg cggtaccgga      840
ccggcaaaac gagacgtcac gcoggatgcg acccttgccg tggcacatcg tgaaatgccg      900
ggcttcggcg agcaaatgcg ccaagtcagc ctgcacttcg taccgaccgc gattctttct      960
cgccaagtgc gtgttattcg tcacgattcg ctaattttaa atttaccggg gcagccgaaa     1020
gcaattaaag aaactcttga aggggtaaaa gacgcacaag gtaatacgct ggtacgaggc     1080
attttcagcg ctgtgccgta ttgcttacia ctattaagtg atatttatat cgacactcgc     1140
tctgaaaatc tgcgaaagtt tccgtccgaa atcagcaaga agataatctt taaaac         1196

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<210> 43
<211> 601
<212> DNA
<213> Actinobacillus pleuropneumoniae

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<400> 43
cgctaaacgt gcatatgttg gtttaggtag caaacagtat ggtgaagtaa catttggtcg      60
tcaattaaca attgctgatg attacgggtca aacagatgat tacgaatacg gtatcgtacc     120
atcatatata gcaacttcag gtaaccaagt gatccgttat gactataaag gtattgaagg     180
tttaciaaatt ggtgcaaact ataatttcgc tgaaaaacgt aatgcgagag gtgaagtttt     240
agtaaatgaa ctcaaaaatg catatggttt aggtgcggtg tatgaaacgc aattaggtgg     300
taacacattt aatgttgaag gtggtatcgg tcgttctaac tatgcaacag gtacaaacca     360
caaacattac caagatgggt atgaattagc attaggttat gctattggtg actttaaatt     420
agtttccgat ttcggttata aatatgagaa aaatgggtgca gcgcgtacta aagcattctt     480
tgtagctcca ggcttccaat accaagttat ccctgcttca cgtatctatg gtaactattt     540
atatgagcgt actgaagtat cagattcaga tgtaaaagggt aaaactcatg gattcttatt     600
a                                                                    601

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<210> 44
<211> 266
<212> DNA
<213> Actinobacillus pleuropneumoniae

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```

<400> 44

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```

taaaaaataac tacggtccga tggtacgtgc tgcgttagag aagatcgaga aggaagggtta      60
agaaaatggg  tttaaaaaat ctttttgaaa agatggaacc tgcgtttcac aaagggtggaa      120
aatatgagaa  atggtacacg ctttttgaag cgacatatac cattctctat acaccaggta      180
cagtgactcg  taaagattca cacgtacgtg atgcgttaga ttctaaacgt atgatgatta      240
tcgtatgggt  agcgttattc ccggca                                266

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```

<210> 45
<211> 1065
<212> DNA
<213> Actinobacillus pleuropneumoniae

```

```

<400> 45
aactaaggat agatatgtta cagaataaga aaattgcagc agttattcca acttttagag      60
tgcttgctca gattgaaacc gttttgaaaa gaatacccca gtattttgat atgatttatg      120
tcgtggatga taaatgtgat caaggtagtg gtaaatttgt tcaagaacat attatggatt      180
ctcgagtaaa agtgcttttt catgaagtga atcaagggtg tggaggagct gttattactg      240
gttataaaca agcaattatc gatcagatgg atgtagtggg taaaattgat ggtgataacc      300
aaatggatcc ttatttggct gaaaaattta ttttaccat tgtaaatgga gatgcagatt      360
atacaaaagg aaatcgatcc tttaaccttt cagacgtagc ggatatgccg aaagtgaggt      420
tttttggtaa tattgctctt tcttttttaa ccaaagcatc atctgggtat tggaaaattt      480
ttgatccgac aaatgggtat acggcaatta gtgttaaagt actaaaaatg ttggcttttag      540
acaagattca aaagcggtac ttttttgaaa gtgatataat attccgattg aatatgatct      600
cagctaaagt attagatgtg ccaatgggtg cagtatatgg agatgaagta tccaatttaa      660
aaattagcaa aatattcttt ccatttctaa aaggaaattt atctaatttt tcaaagagaa      720
ttttctataa atatttcttg caagatttta atgttgcttc tgttgaatta gtatttggtg      780
cagtaatgtc attattcgga atattatttg gactatataa ttggattgct aatgcaatta      840
ataatataga aacaccaaca ggaaccatta tgatttctgc attgtttatt ttagtaggaa      900
ttcatttatt actctctttt atatcttatg atgtaaataa ttatccaacg gaatcaatta      960
gtaaaaattt agatgaataa tcccatttgt tctgttattg tttgttatga accaactaag     1020
aaaatatttt ttttaatcaa ctctctaatt aagcagaatg tatat                                1065

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<210> 46
<211> 155

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<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 46

```

ggaaggctta aaacagctgt ttcaggggaag tcaccccgctc aaaaaactga tacgaggcgt      60
aggtttatcc gcaaccaatc aactaccggt attaaagaaa ttattgattg ctcaggcggt      120
gggtatttga cttgtctgtt ttttagtcag ataataa                                155

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<210> 47

<211> 771

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 47

```

tttttggcgt tttagaaaag tcgcaaattt ttccggtctt ttttggtgat aggcgaaagt      60
catcgtggac tcctttaata agaaagtgga agatttggtc gaattacaat caatcgaagt      120
ttatttgta caataaaaaa atgaaatctt tgaactactc cacaaattaa ttgagcaagc      180
ggttaaatat acaaattttt ttgcaaattc aaccgctttc cattagaatt ataagacttt      240
tggttgctgat tctggattcg acgggattag cgaagtccaa ggtgcacgct gaggtgaggc      300
aggcctcgta aacaaaccgc aaaaaaatag tcgcaaacga cgaacaatac gcttttagcag      360
cttaataacc tgctcatagc cttatcgctt cagcttccgc tcgtaagacg agggcaacga      420
taagtcaccc aaaacgagat cgtgtggacg ccgccgtttg aggatcgaaa cactaaattg      480
aatcaaaacta gcttatttct tgcgtgtctg tccgctggag gtaagtgaat ttaaagacca      540
gactaaacgg actaaacgtg tagtgctgaa gatggagtaa tttcggacgg ggggttcaaat      600
ccccccagct ccaccaaatt tgtatacttt taatagggtt tttaaaatga aattccacca      660
aaaactaaat agaactgcca aaactgcagt ggctattgca cttagtagtt ttggtgtatt      720
aggatatgtc tcattagata atgtcactca atctattgaa aatataagaa t                                771

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<210> 48

<211> 313

<212> DNA

<213> Actinobacillus pleuropneumoniae

<400> 48

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ggtcggcgat aagatcgtaa gtgtcgggtc ggataacgat gagattgaag atgttatcgg      60
ctggcggtta gatgatgttg tcgataagat catacgtact aatgggtact aagtccggtt      120
cgaaattgaa ccggaaaaag gcggtgaaac gaaagttatc actttgggtc gagataaagt      180

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ccgttttagaa gacagtgcgg cgaaattaac cgttgataaa attaacggta aaaatgtcgc 240
 ggtaattaaa atttcaacgt ttacatcgg ttgaccaat gatgtgcgta aattattaga 300
 tgaaatgtac act 313

<210> 49
 <211> 225
 <212> DNA
 <213> Actinobacillus pleuropneumoniae

<400> 49
 ttcttaattt caggccattt tttatcttta agatagagat taattacatc gtttttaaca 60
 cgttgttccc atagctgatt ggcttcttca accgttgcgg gaaacgccgc cttttcacga 120
 tcattttcga ttgatccga cctttttaa ttcggctctt tatctaataa agacaacgca 180
 tacttataac gtccataacc gacgtttggt cattaaatca tagat 225

<210> 50
 <211> 1045
 <212> DNA
 <213> Actinobacillus pleuropneumoniae

<400> 50
 attcgtgccg cattagtga atacgatccg aaaaatgccg aaagctataa ccaaaatgct 60
 aaagtttatg cagaaaaagt aaaagcaatt gccgaaccgt tacgccaacg tctatccgtt 120
 attccggaag cacaacgttg gttagtaacc agtgaagggtg cattcagtta ttagcacag 180
 gactatcaat taaaagagct ttatctctgg gcaattaatg ctgaagagca aggctcgccg 240
 caacaagtga aaaaagtaat tgacgggtga aaagccaaca atatccctgt tgttttcagc 300
 gaaagcaccg tatcggataa accggctaaa caagttgcta aagaaaccgg tgcattatac 360
 ggcgggtgtg tatatgttga ttcactttca actaaggatg gtgctgttcc aacttattta 420
 gatctattaa aagtcactat aagtacaatt gtggacgggt ttgaaaaaag taaaaaataa 480
 catggtatcc attcctactt ctatttccgt tgaaaagcta agtgagctaa gtgtccgtta 540
 taataacggg catttagcct tatatgacgt atccttccaa ctgcaaaacg gtacgatttg 600
 cgccctaate ggcgtaaacg gcggcggtta atccacacta tttaaaagtt taatgggatt 660
 agttaaacct caaacggta caattctgtt aaaccgaatg ccgattcaac aagcattgaa 720
 acaaaatctg gtgtcttatg taccgcaaag tgaagagggtc gattggcaat ttccggtttc 780
 cgttttacgat gtcgttatga tgggacgtta cggttatatg ggattgctac gccgtccttc 840

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atctcttgat aaacaaaaag tgatgcaagc gatggaacga gtggatattt gccacttgca 900
gcacgcgcaa atcgggtgaac tttccggcgg gcagaaaaaa cgcgtgtttc ttgctcgagc 960
attagcgcaa gaaagccaaa ttattttgct tgacgagccg tttaccggtg ttgatgtaaa 1020
aaccgaaaat gccattggtg gaatt 1045

<210> 51
<211> 263
<212> DNA
<213> Actinobacillus pleuropneumoniae

<400> 51
tttttagata gcgtgaaaaa cttcttctct aacttaggta aacactaaag attaaaaagg 60
cttagcgaat ttgctaagcc ttttatttta ggcatagtag acaaaaagggt tggtaaaaag 120
tgggttaaag ccttatagta caaggcttta acctaccttt tgaaatatga ataaaaactt 180
gccctttttg tcaatcttcc aaacacaaaa gtatggctta aaaataagct tcaacgttat 240
aaatgttcag cttgcaataa aat 263

<210> 52
<211> 1195
<212> DNA
<213> Actinobacillus pleuropneumoniae

<400> 52
cttccgatga tacggaaatt ttagtTTTTT taactcaaga tgctttattt gcaagttcag 60
attctctaga agaattaata aaacctttcc aagatcctga agtaggggct gtttatggta 120
ggcagttacc tcacaaagat gcgactctat tagctgcca tgccagggtta ttttaattatc 180
ctcctaaaag tataattaag tcgaaagaga gtatttcgga gttaggatta aaaacagcat 240
ttatctctaa ttcttttgcc gcataccgct gttctatttt tgaagaactc ggagggtttc 300
ctgagaaaaac gatttttagcg gaagatatgt acttggtgc taagataatc ttgaatgggt 360
ataaaattgt ttataatgcg gaggcaaaag tctatcattc ccataactat tctttgatcc 420
aagagtttca gagatatttt gatactggag tattccaaaa agagcaatct tggattagaa 480
aagaatttgg tgaagcaaat aatgagggtg aaaagtttgt atgttctgag attaagtatt 540
tattgaagaa taatttttta ctattgtcga aagctatatt tcacactatg ttttaagtttt 600
tagggtttaa attaggtttg aattatgaga aattacctag atggttatgt ataaaattta 660
gtatgcataa gaactattgg aaataaatca tgaaaaggca gatattatct aaatatacgt 720

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tagctataag tgatttttatt agttttttctc tatcatttat tctatcttta gtattattaa      780
attattcaat tgagagggtt gatgcttata tcccacttga tcaagttaga gaaagaatga      840
ttatccactt atcgtttagt tttatagggtg ttatatgggt ttggattagg cttcgccact      900
atacttatcg taaacctttt ggtttgaact aaaagaagtg atcagaacac ttattattct      960
tgctatatatt agctagctac tatagccttt tcaaagcttt atttttctcg ctattatggg     1020
gtttaacttg ggggtgttaca ttcttctttg ttcttattgt tcgtatttaa ctaaaaaaat     1080
cttaattgat acgggactat atattaagaa tacagtatta ttgggtggagg gaataatgcg     1140
attgatgcct ataaagcctt aactagttag tcttatttag ggtaaaaagt aaaat           1195

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<210> 53
<211> 288
<212> DNA
<213> Actinobacillus pleuropneumoniae

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```

<400> 53
ggatctttca ttacctttat caccataccg ctaccatctt cgagtaacca agagaagcat      60
ccgatttcgg atcataagca ccgatacgaa cttgttcgac taaaacaacg ctatcacgaa     120
cgggatcgta agcgattaat gccgcgctg cccctataat cagtaattca cgcacgattt     180
caccgctcat ttcaccggag aatagcttat gtcggaaata cattttcttt aattcaaaat     240
gccctttata aacggtttct tctttaatca tgttgaagat actgttga                    288

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```

<210> 54
<211> 290
<212> DNA
<213> Actinobacillus pleuropneumoniae

```

```

<400> 54
gcggacaata caatctctc cattgtctc ggcttcattc tacactataa tccgttcaat      60
ccggtgcaac gcacggctta taagaggaac gccaatatat tctggtacac gttgtcagcc     120
gatatcaagc ctatcaatgg gtgtgtgaag gcaaaatcga taatgttata gcagtggtcg     180
gtttacaatg gttacaactt aattatcaaa aatatcgagt gtaatgagcg ttttccgata     240
acgacgaata tattttgccc tctttaatga gggcaaattt tttgaagtat                    290

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```

<210> 55
<211> 47
<212> DNA
<213> Actinobacillus pleuropneumoniae

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<400> 55
cgctcatcac caaacacttg aggttctaag agttttacat ccggaat 47

<210> 56
<211> 241
<212> DNA
<213> Actinobacillus pleuropneumoniae

<400> 56
cgcacctaga tatcgggata cgcgcggtca attaggcatc tataccgaaa cgggtttatt 60
atcagttcaa aataacgtat taccgcaact tggtaaaaag taatcttgat ctaatgcttt 120
agaaaactta gaattaatca aaagcccat agtttatgct ttggggcttt aattttttca 180
tcagttttta aattaagcgg tcaaaaatta agaatgtttt gcaaatgaaa ttagttgaaa 240
t 241

<210> 57
<211> 19
<212> DNA
<213> artificial sequence

<220>
<223> synthetic primer

<400> 57
cgactacaac ctcaagcta 19

<210> 58
<211> 18
<212> DNA
<213> artificial sequence

<220>
<223> synthetic primer

<400> 58
cgaccattct aaccaagc 18

<210> 59
<211> 28
<212> DNA
<213> artificial sequence

<220>
<223> synthetic primer

<400> 59
cgccatgtcg accattctaa ccaagctt 28

- 31 -

<210> 60
<211> 27
<212> DNA
<213> artificial sequence

<220>
<223> synthetic primer

<400> 60
cgcctagtcg actacaacct caagctt

27

<210> 61
<211> 9
<212> DNA
<213> artificial sequence

<220>
<223> synthetic primer

<400> 61
gtcgaccct

9

<210> 62
<211> 9
<212> DNA
<213> artificial sequence

<220>
<223> synthetic oligonucleotide

<400> 62
gtcgacagg

9

<210> 63
<211> 19
<212> DNA
<213> artificial sequence

<220>
<223> synthetic primer

<400> 63
gacaagatgt gtatccacc

19